The Rejection of Claims 54, 55, 56, and 57 under 35 U.S.C. § 112, ¶1:

Claims 54, 55, 56, and 57 were rejected under 35 U.S.C. § 112, ¶1 as containing subject matter that was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. In particular, the Examiner stated that the specification appears void of any disclosure or description of what exactly the "curing catalyst" is that is claimed in claims 54, 55, 56, and 57. The Applicant respectfully disagrees.

It is well settled that the specification of a patent application does not have to teach that which is well known in the art. See, e.g., *Hybritech v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367 (Fed. Cir. 1986), cert. denied, 480 U.S. 947 (1987). In the specification of the present application, the "curing catalyst" is referred to on page 7, lines 24-28, page 11, lines 2-3, page 11, lines 5-6, page 11, lines 25-26, and page 12, lines 1-2.

The terms curing, catalyst, and curing catalyst are well-known terms of art with regard to the use of adhesive materials. For example, the online Chemistry Dictionary at www.netaccess.on.ca/~dbc/cic_hamilton/dictionary/c.html defines catalyst as a substance that alters the rate at which a reaction occurs (copy attached). Furthermore, with regard to a specific example of a conventional adhesive - epoxy - the website www.epoxies.com/curing.html give examples of widely used curing catalysts for epoxy adhesives (copy attached). In addition, the website www.sunilbhangale.tripod.com/epoxy.html provides a good discussion of the well known properties of epoxy adhesives and the typical curing catalysts for epoxies (copy attached). Finally, a cursory search of the records of the U.S. Patent Office database indicates that probably thousands of U.S. patents include reference to the use of curing catalysts for adhesives (copy attached). Thus, it is overwhelmingly apparent that the use of curing catalysts for adhesives is well known in the art. Therefore, the claimed subject matter of claims 54, 55, 56, and 57 is described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

For the reasons set forth above, it is submitted that the outstanding rejections of claims 1-7, 28-30, and 37 are overcome. Furthermore, new claims 42-58 are in condition for allowance.

Unless stated otherwise, none of the amendment to the claims were made for reasons substantially related to the statutory requirements for patentability.

Furthermore, unless stated otherwise, the amendment to the claims were made to simply make express what had been implicit in the claims as originally worded and therefore is not a narrowing amendment that would create any type of prosecution history estoppel.

Conclusion

In view of the foregoing amendments and remarks, it is respectfully submitted that the pending claims are drawn to novel subject matter, patentably distinguishable over the prior art of record. The Examiner is therefore respectfully requested to reconsider and allow claims presented for reconsideration herein. To the extent that the present amendment results in additional fees, the Applicant authorizes the Commissioner to charge deposit account no. 08-1394.

Should the Examiner deem that any further amendment is desirable to place this application in condition for allowance, the Examiner is invited to telephone the undersigned at the below listed telephone number.

S/N 09/679,906

Respectfully submitted,

Todd Mattingly
Registration No. 40,298

Dated: 9/4/2002

HAYNES AND BOONE, L.L.P.
1000 Louisiana Street
Suite 4300
Houston, Texas 75002-5012
Telephone: 713/547-2301
Facsimile: 713/547-2600
File: 25791.37.02

EXPRESS MAIL NO. EL 844685527US

DATE OF DEPOSIT: September 4, 2002

This paper and fee are being deposited with the U.S. Postal Service Express Mail Post Office to Addressee service under 37 CFR §1.10 on the date indicated above and is addressed to the BOX Non-Fee Amendment, Assistant Commissioner for Patents, Washington, D.C. 20231.

Michelle Baxter
Name of person mailing paper and fee

Michelle Baxter
Signature of person mailing paper and fee

Chemistry Dictionary

Terminology "C"

A	B	C	D	E	F	G	H	I	J	K	L	M
N	O	P	Q	R	S	T	U	V	W	X	Y	Z

Calorie
: The amount of heat required to raise the temperature of one gram of water from 14.5°C to 15.5°C.
1 calorie = 4.184 joules.

Calorimeter
: A device used to measure the heat transfer between system and surroundings.
For further information see Analytical Chemistry

Canal Ray
: Stream of positively charged particles (cations) that moves toward the negative electrode in cathode ray tubes; observed to pass through canals in the negative electrode.

Capillary
: A tube having a very small inside diameter.

Capillary Action
: The drawing of a liquid up the inside of a small-bore tube when adhesive forces exceed cohesive forces, or the depression of the surface of the liquid when cohesive forces exceed the adhesive forces.

Carbanion
: An organic ion carrying a negative charge on a carbon atom.

Carbonium ion
: An orgainic ion carrying a positive charge on a carbon atom.

Carcinogen
: A substance capable of causing or producing cancer in mammals.

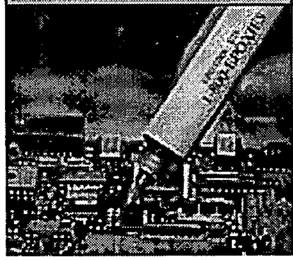
Catalyst
: A substance that speeds up a chemical reaction without being consumed itself in the reaction.
A substance that alters (usually increases) the rate at which a reaction occurs.

Catenation
: Bonding of atoms of the same element into chains or rings.
The bonding together of atoms of the same element to form chains.
The ability of an element to bond to itself.

Epoxies, Etc...

Epoxy Curing Agents

1-800-EPOXIES
Search | Careers | Contact Us



Home
What's New
Products
Equipment
MSDS Search
Glossary
Order Online
Request Sample

Selecting the correct curing agent for a two component epoxy system is just as important as selecting the correct resin. Listed below are many of the curing agents that can be selected with Epoxies, Etc's... resins. They offer different pot lifes, viscosities, durometers, and temperature capabilities.

Our Most Popular Curing Agents

- **Room Temperature Cure**
  - Catalyst 190
    Hardest and best chemical resistance from a room temperature curing agent.
  - Catalyst 150
    Water clear, low viscosity and excellent thermal shock resistance.
- **Heat Cure**
  - Catalyst 105
    Provides best balance of properties. Outstanding heat and chemical resistance.
  - Catalyst 179
    Best high temperature resistance.

Technical detailed information on several of our curing agents is listed below.

Go to Conversions, Measures, and Weights

EPOXY RESIN CURING AGENTS

CATALYST	VISCOSITY CPS@25°C	WORKING TIME 100GRMS@25°C	TYPICAL CURE SCHEDULE	TYPICAL OPERATING TEMPERATURE °C	DESCRIPTION & APPLICATIONS
4	6,000	24 hours	4 hrs.@60°C	-20 to 230	High temperature resistant, heat cure catalyst. Very good

			1-3 hrs.@150°C		chemical resistance. May be used as accelerator with catalyst #179.
5	25,000	2 hours	24 hrs.@25°C 3 hrs.@65°C	-70 to 100	Good thermal shock room temp. curing catalyst. Very low toxicity. Provides flexible castings with outstanding adhesion.
6	15,000	2 hours	24 hrs.@25°C 3 hrs.@65°C	-70 to 100	Low viscosity version of catalyst #5.
22	12,000	8 hours	24 hrs.@25°C +3-5 hrs.@100°C	-65 to 205	Heat curing high heat resistant curative for small to very large castings. Designed for tooling applications.
23	840	45 minutes	24 hrs.@25°C 3 hrs.@65 °C	-40 to 135	General purpose room temperature curative for small to medium size castings. Designed for tooling applications.
105	60-75	4-6 hours	3 hrs.@100°C 30-60 min.@170°C	-70 to 180	Outstanding heat and chemical resistant curative. Provides long pot life and meets Mil-1-16923. If crystallization occurs heat to 65°C.
140	10-25	30 minutes	12 hrs. @ 25°C 1-2 hrs.@65°C	-50 to 150	Water clear, very low viscosity room temp. curing agent. Good thermal shock resistance. Excellent adhesion to glass.
145	20-30	60 minutes	18 hrs.@25°C 3 hrs.@65°C	-50 to 150	Slower curing version of Cat. #140 with longer working time.
150	60	60 minutes	24 hrs.@25°C 3 hrs.@65°C	-50 to 135	General purpose low viscosity room temp. curing agent. Forms glass like castings. Excellent system for most potting

					applications.
179	Slury	24 hours	3 hrs.@100°C +3 hrs.@175°C	-20 to 230	Very high heat resistant curing agent. Designed for applications requiring optimum heat resistance. Long pot life. May crystallize at room temperature.
190	100	45 minutes	16 hrs.@25°C 2-4 hrs.@65°C	-65 to 160	Low viscosity, general purpose, room temp. curing agent. Provides very rigid castings with excellent physical strength and chemical resistance.
240	35	40 minutes	12 hrs.@25°C 1-2 hrs.@65°C	-70 to 180	Room temperature curing agent. Provides better heat resistance in a room temp. cure system.

IMPORTANT: *The information in this table is based on data obtained by our own research and is considered accurate. However, no warranty is expressed or implied regarding the accuracy of these data, the results to be obtained from the use thereof, or that any such use will not infringe any patent. This information is furnished upon the condition that the person receiving it shall make his own tests to determine the suitability thereof for his particular purpose.*

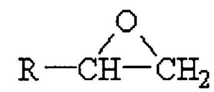
Having trouble deciding on which of our products best meets your requirements? Then let us assist you in selecting a product by using our online Product Selection Form. If we do not have an existing product that meets your requirements, we will develop one!

Epoxies, Etc...
21 Starline Way, Cranston, RI 02921 USA
Phone: 401-946-5564 Fax: 401-946-5526

1-800-EPOXIES
Email: sales@epoxies.com
Directions to Epoxies Etc...

Epoxy Resins

Epoxy resin is defined as a molecule containing more than one epoxide groups. The epoxide group also termed as, oxirane or ethoxyline group, is shown below,



These resins are thermosetting polymers and are used as adhesives, high performance coatings and potting and encapsulating materials. These resins have excellent electrical properties, low shrinkage, good adhesion to many metals and resistance to moisture, thermal and mechanical shock.

Viscosity, epoxide equivalent weight and molecular weight are the important properties of epoxy resins.

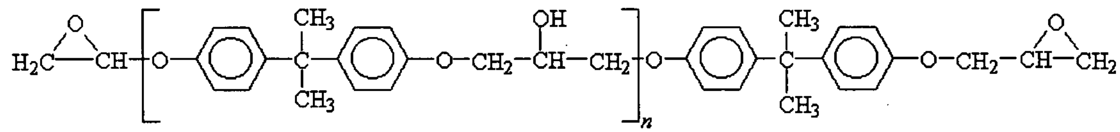
Types of Epoxy Resins:

There are two main categories of epoxy resins, namely the glycidyl epoxy, and non-glycidyl epoxy resins. The glycidyl epoxies are further classified as glycidyl-ether, glycidyl-ester and glycidyl-amine. The non-glycidyl epoxies are either aliphatic or cycloaliphatic epoxy resins. Glycidyl epoxies are prepared via a condensation reaction of appropriate dihydroxy compound, dibasic acid or a diamine and epichlorohydrin. While, non-glycidyl epoxies are formed by peroxidation of olefinic double bond.

Glycidyl-ether epoxies such as, diglycidyl ether of bisphenol-A (DGEBA) and novolac epoxy resins are most commonly used epoxies.

Diglycidyl Ether of Bisphenol-A (DGEBA):

Diglycidyl ether of bisphenol-A (DGEBA) is a typical commercial epoxy resin and is synthesised by reacting bisphenol-A with epichlorohydrin in presence of a basic catalyst.

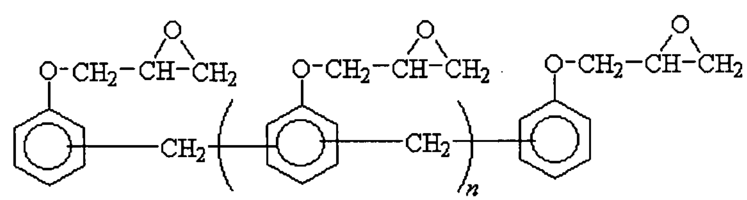


structure of DGEBA

The properties of the DGEBA resins depend on the value of *n*, which is the number of repeating units commonly known as degree of polymerisation The number of repeating units depend on the stoichiometry of synthesis reaction. Typically, *n* ranges from 0 to 25 in many commercial products.

Novolac Epoxy Resins:

Novolac epoxy resins are glycidyl ethers of phenolic novolac resins. Phenols are reacted in excess, with formaldehyde in presence of acidic catalyst to produce phenolic novolac resin. Novolac epoxy resins are synthesised by reacting phenolic novolac resin with epichlorohydrin in presence of sodium hydroxide as a catalyst.



Structure of novolac epoxy resin

Novolac epoxy resins generally contain multiple epoxide groups. The number of epoxide

groups per molecule depends upon the number of phenolic hydroxyl groups in the starting phenolic novolac resin, the extent to which they reacted and the degree of low molecular species being polymerised during synthesis. The multiple epoxide groups allow these resins to achieve high cross-link density resulting in excellent temperature, chemical and solvent resistance. Novolac epoxy resins are widely used to formulate the moulding compounds for microelectronics packaging because of their superior performance at elevated temperature, excellent mouldability, and mechanical properties, superior electrical properties, and heat and humidity resistance.

Curing of Epoxy Resins

The curing process is a chemical reaction in which the epoxide groups in epoxy resin reacts with a curing agent (hardener) to form a highly crosslinked, three-dimensional network. In order to convert epoxy resins into a hard, infusible, and rigid material, it is necessary to cure the resin with hardener. Epoxy resins cure quickly and easily at practically any temperature from 5-150^{o}C depending on the choice of curing agent.

Curing Agents (Hardeners)

A wide variety of curing agent for epoxy resins is available depending on the process and properties required. The commonly used curing agents for epoxies include amines, polyamides, phenolic resins, anhydrides, isocyanates and polymercaptans. The cure kinetics and the T_g of cured system are dependent on the molecular structure of the hardener. The choice of resin and hardeners depends on the application, the process selected, and the properties desired. The stoichiometry of the epoxy-hardener system also affects the properties of the cured material. Employing different types and amounts of hardener which, tend to control cross-link density vary the structure.

The amine and phenolic resin based curing agents, described below, are widely used for curing of epoxy resins.

Amine based curing agents:

Amines are the most commonly used curing agents for epoxy cure. Primary and secondary amines are highly reactive with epoxy. Tertiary amines are generally used as catalysts, commonly known as accelerators for cure reactions. Use of excessive amount of catalyst achieves faster curing, but usually at the expense of working life, and thermal stability. The catalytic activity of the catalysts affects the physical properties of the final cured polymer.

Phenolic novolac resins:

Epoxy resins when cured with phenolic hardener, gives excellent adhesion, strength, chemical and flame resistance. Phenolic novolac-cured epoxy systems are mainly used for encapsulation because of their low water absorption, excellent heat and electrical resistance. An accelerator is necessary for the complete cure to occur. Figure 2.4 shows cure reaction of epoxy resin with phenolic hardener.

Rubber Toughening of Epoxy Resins

The usefulness of epoxy resins in many engineering applications is often limited by their brittle nature and poor thermal conductivity. The term toughness is a measure of material's resistance to failure i.e. the total amount of energy required to cause failure.

There are several approaches to enhance the toughness of epoxy resins which includes: (i) chemical modification of the epoxy backbone to make it more flexible structure, (ii) increasing the molecular weight of epoxy, (iii) lowering the cross-link density of matrix, (iv) incorporation of dispersed toughener phase in the cured polymer matrix, and (v) incorporation of inorganic fillers into the neat resin.

Amongst these approaches, toughening via dispersed toughener (flexibiliser) phase has been shown to be most effective. The flexibilisers can be reactive or non-reactive rubber.

Toughening Agents

Various types of thermoplastic polymers as well as reactive rubbers are employed to enhance

toughness of epoxy resin. Thermoplastic polymers, such as polyetherimide, polysulphone, polyethersulphone, and polycarbonate have been studied to modify epoxy resins. These studies show significant improvement in the toughness of epoxy resins.

The reactive rubbers used for toughening epoxy resins include, liquid acrylonitrile-butadiene copolymers with various terminal groups, polysiloxanes, polyepichlorohydrin, and polyurethanes.

Although liquid acrylonitrile-butadiene copolymers with carboxyl- (CTBN) and amine- (ATBN) terminated groups have been widely used for epoxy toughening, the relatively high glass transition temperature of the copolymer limits their low-temperature applications. In addition, these copolymers also increase the CTE value of the moulding compound. Also the presence of unsaturated structure of butadiene system is prone to thermal instability and thus unsuitable for long term use at higher temperatures.

Polysiloxanes have excellent thermal stability, moisture resistance, good electrical properties, low stress and lower T_g values. However polysiloxanes are not compatible with epoxy resins. Addition of compatibilisers such as, methylphenylsiloxane enhances the compatibility but at the same time raises the T_g of polysiloxane modifier restricting its low temperature applications.

Home * Personal * Profile * Album * Marathi version * Nature * Links * Music